STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME II

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX Y

TECO MODEL 48 CARBON MONOXIDE ANALYZER

MONITORING AND LABORATORY DIVISION

APRIL 1996

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APPENDIX Y.1

STATION OPERATOR'S PROCEDURES

FOR

TECO MODEL 48 CARBON MONOXIDE ANALYZER

MONITORING AND LABORATORY DIVISION

APRIL 1996

Y.1.0 GENERAL INFORMATION

Y.1.0.1 THEORY OF OPERATION

The TECO Carbon Monoxide (CO) Analyzer measures the amount of infrared light absorbed by CO in a sample of ambient air. The quantity of light absorbed is proportional to the concentration of CO in the air sample. A detailed discussion of the analyzer's measurement principle is contained in the Manufacturer's Instruction Manual. This appendix supplements the Manufacturer's Manual with instructions for servicing and troubleshooting the analyzer. Separate appendices are available for the analyzer acceptance test and calibration.

Y.1.0.2 ANALYTICAL CYCLE

The analyzer determines the concentrations of CO in ambient air by passing nondispersive single beam infrared (IR) radiation through a rotating gas filter wheel to the sample cell and then the detector. The wheel contains two different entrapped gases: CO and nitrogen. The CO side of the wheel acts to produce a reference beam which cannot be further affected by CO in the sample cell. The nitrogen side of the filter wheel is transparent to the IR radiation and therefore produces a measure beam which can be absorbed by CO in nonlinear to the CO concentration. The detector converts the light to electrical energy, and the signal processing electronic system manipulates the electrical information and displays the CO concentration. Figure Y.1.0.1 illustrates the analyzer flow. For further details, refer to the Manufacturer's Instruction Manual.

Y.1.0.3 CAUTIONS

1. Prior to cleaning the analyzer, place the MAIN power switch to the OFF position, and unplug the power cord. Avoid the use of chemical agents which might damage components.

2. Always use a three-prong, grounded plug on this analyzer.

3. Adhere to general safety precautions when using compressed gas cylinders (e.g., secure cylinders, vent exhaust flows).

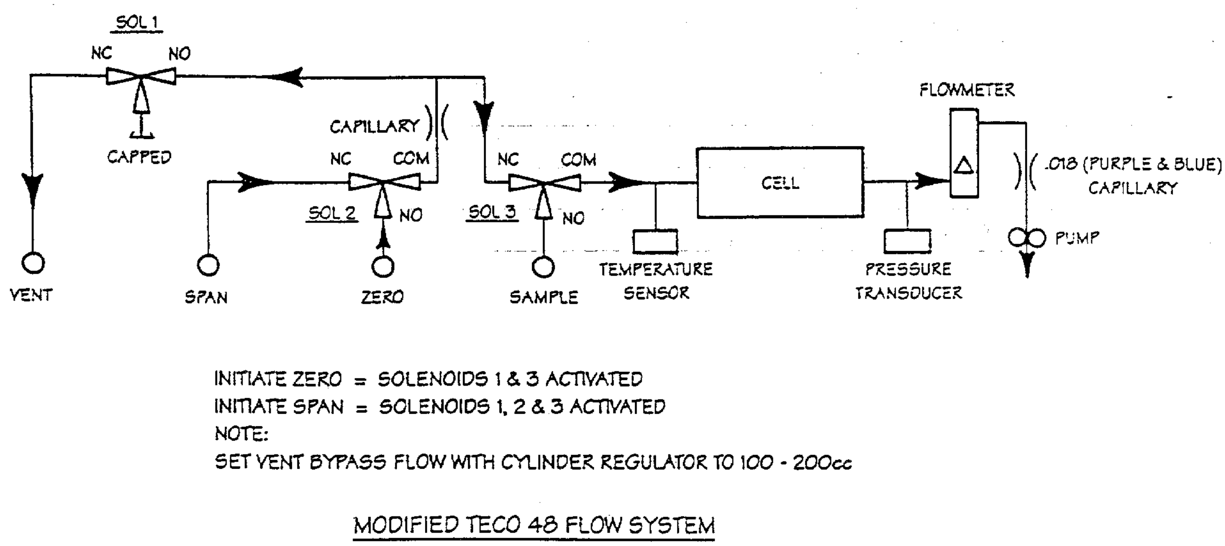

Figure Y.1.0.1
Gas Flow Diagram

Y.1.1 INSTALLATION PROCEDURES

Y.1.1.1 PHYSICAL INSPECTIONS

1. Unpack the analyzer and check it for shipping damage.

2. Remove the cover by loosening the four latches on the sides of the cover and sliding the cover back and up. Check the plumbing for tightness. Make sure that all printed circuit boards are firmly seated and that other components have not become loose or damaged in shipment. Replace the cover and tighten the latches.

Y.1.1.2 INITIAL START-UP

1. Connect the sample line and span gas to the proper fittings on the back of the analyzer. Connect the port marked "VENT" to an appropriate outside vent.

   NOTE: Do not pressurize this port.

2. Connect a recorder and the data acquisition system to the back of the analyzer.

3. Refer to the Manufacturer's Instruction Manual Chapter III to become familiar with all controls and functions.

4. Turn on the analyzer in accordance with the procedure outlined in the Manufacturer's Instruction Manual. The analyzer automatically enters the start-up mode. See Manufacturer's Manual Chapter III, Section B, for details.

Y.1.1.3 CALIBRATION PROCEDURES

See Appendix Y.3.0.

Y.1.2 ROUTINE SERVICE CHECKS

Y.1.2.1 GENERAL INFORMATION

The following routine service checks are performed in accordance with the maintenance schedule (Table Y.1.2.1). Perform the checks at least at the prescribed intervals. A Monthly Quality Control (QC) Maintenance Checksheet (Figure Y.1.2.1) should be completed weekly and the original forwarded monthly to the station operator's supervisor.

Y.1.2.2 DAILY CHECKS

The front panel flow meter should indicate the flow representing approximately 1.0 slpm as indicated on the most recent calibration report. Check the recorder chart and the digital display for any indication of analyzer malfunction.

Y.1.2.3 WEEKLY CHECKS

All initial and final readings should be recorded on the Monthly Quality Control Maintenance Checksheet.

1. Zero - Check the analyzer zero using the procedure given in the Manufacturer's Instruction Manual. Adjust the zero if the deviation is greater than ±0.5% full scale (FS).

2. Span - Check the analyzer span using the procedure given in the Manufacturer's Instruction Manual. Adjust the span if the deviation is greater than ±1.0% FS.

3. Sample Flow - The front panel flow meter should indicate a flow representing approximately 1.0 slpm.

4. Change the inlet particulate filter (see the maintenance section of the Manufacturer's Instruction Manual).

Y.1.2.4 MONTHLY CHECKS

1. Monthly Quality Control Maintenance Checksheet - Monthly, forward the checksheet to your supervisor.

2. Check IR detector light intensity. The reading should be at least 10,000 Hz.

Y.1.2.5 ANNUAL CHECKS

Perform a multi-point calibration as outlined in Section Y.3.0.

Table Y.1.2.1

MAINTENANCE SCHEDULE FOR THE
TECO MODEL 48 CARBON MONOXIDE ANALYZER

	Daily*	Weekly	Monthly	Annually
	X			
	X			
	X			
		X		
		X		
		X		
		X**		
		X	X	
Clean Optics	As required			
IR Source Replacement	As required			
Calibration				X

* Or each day on which an operator is in attendance.

**Environmental conditions may require more frequent change.

CALIFORNIA AIR RESOURCES BOARD
MONTHLY QUALITY CONTROL MAINTENANCE Checksheet
TECO MODEL 48 CARBON MONOXIDE ANALYZER

LOCATION:__________________________ MONTH/YEAR:____________________

STATION NUMBER:___________________ TECHNICIAN:_____________________

ANALYZER PROPERTY NUMBER:________ AGENCY:_________________________

	Reading: Display/Data Logger Zero		Span		Gas Cylinder Checks		Sample Flow Setting	
Date	As Found	Final	As Found	Final	Zero Setting	Span Setting	As Found	Final
	/	/	/	/				
	/	/	/	/				
	/	/	/	/				
	/	/	/	/				
	/	/	/	/				
	/	/	/	/				

Operator Instructions:

1) Daily Checks: Air Flow (Record Weekly), Chart Trace.
2) Weekly Checks: Zero and Span, Change Particulate Filter.
3) Monthly Intervals: Detector IR Intensity. Date Last Changed:_______________
4) Annual Checks: Calibration. Date of Last Calibration:________________________
5) As Required: Clean Optics and replace IR source.

Date	Comments or Maintenance Performed:

MLD-133 10/95 Reviewed By:______________________________ Date:_________________

Figure Y.1.2.1
Monthly Quality Control Maintenance Checksheet

Y.1.3 DETAILED MAINTENANCE PROCEDURES

Y.1.3.1 CHANGING THE INLET SAMPLE FILTER

Use the procedures outlined in the Manufacturer's Instruction Manual, Chapter I, Figures I-2 and I-4 and Chapter II, page II-3.

Y.1.3.2 SERVICING THE SAMPLE PUMP

Use the procedure outlined in the Manufacturer's Instruction Manual, Chapter VIII, page VIII-5.

Y.1.3.3 CLEANING THE OPTICS

Use the procedure outlined in the Manufacturer's Instruction Manual, Chapter V, page V-1.

Y.1.3.4 SYSTEM LEAKS AND PUMP CHECK OUT

Use the procedure outlined in the Manufacturer's Instruction Manual, Chapter V, page V-5.

Y.1.3.5 REPLACING THE IR SOURCE

See Manufacturer's Instruction Manual, Chapter V, Figure V-1 and Figure Y.1.3.1.

1. Obtain a replacement IR source.
2. Make sure that the power to the analyzer is turned off.
3. Remove the analyzer cover.
4. Disconnect source cable from source cover.
5. Remove the IR source unit by removing two screws that hold the source cover to chopper motor plate.
6. Replace the old source with a new one by loosening the two screws that screw the IR source to the element support standoffs.
7. Reinstall the source unit, reconnect the source cable, and return the unit to operation.

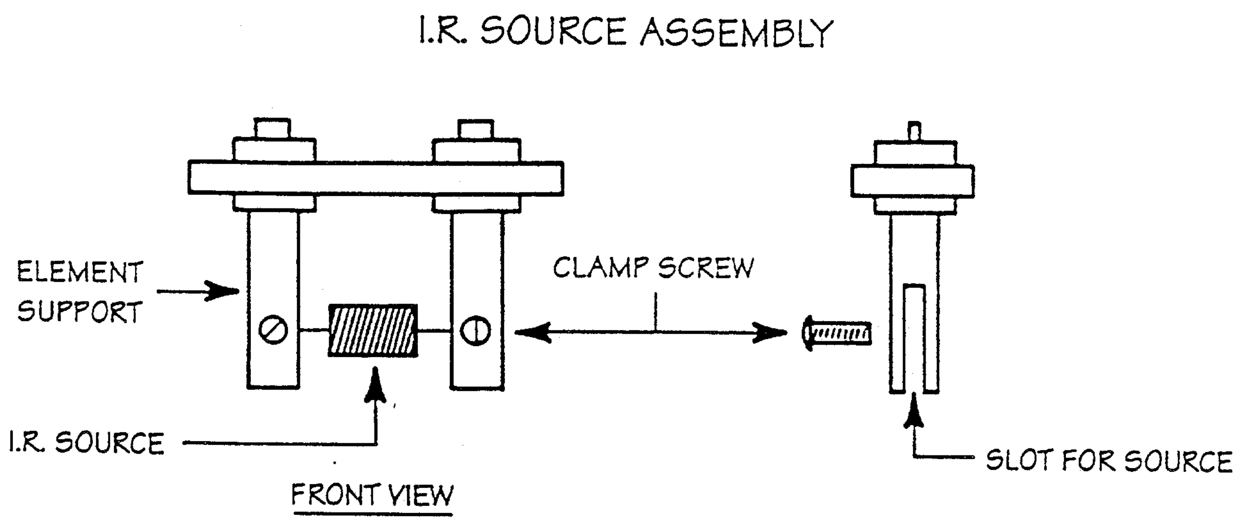

Figure Y.1.3.1
Source Module Assembly

Y.1.4 **TROUBLESHOOTING**

Y.1.4.1 GENERAL INFORMATION

The Manufacturer's Instruction Manual, Chapter VII, contains information pertaining to troubleshooting and should be your first source of information. Additional problems which may occur are outlined below. Space is provided on the Monthly QC Checksheet for recording malfunctions, causes, fixes, and actions taken to prevent recurrence.

Cautions listed in Section Y.1.0.3 should be observed. Additionally, when moving or installing printed circuit boards or other components, turn the analyzer off and unplug the power cord.

Y.1.4.2 ELECTRONIC MALFUNCTIONS

See Manufacturer's Instruction Manual, Chapter VII, and remedy malfunctions.

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APPENDIX Y.2

ACCEPTANCE TEST PROCEDURES

FOR

TECO MODEL 48 CARBON MONOXIDE ANALYZER

MONITORING AND LABORATORY DIVISION

APRIL 1996

Y.2.0 ACCEPTANCE TEST PROCEDURES

Y.2.0.1 GENERAL INFORMATION

The Manufacturer's Instruction Manual should be read thoroughly before beginning analyzer acceptance testing. In addition, a maintenance log book and an Acceptance Test "Mini" Report (Figure Y.2.0.1) should be initiated and pertinent information should be recorded.

Y.2.0.2 PHYSICAL INSPECTIONS

Unpack the analyzer and check for physical damage if this has not already been done. Verify that the analyzer is complete and includes all options and parts required by the purchase order. Remove the top cover from the analyzer and perform the following checks:

1. Make sure that all circuit boards are properly seated in their connectors by removing and reinserting each board.

2. Check for correct power cord phasing; standard wiring configuration has the black wire connected to the brass terminal of the plug, white to the copper terminal, and green to earth ground.

3. Start up the analyzer following the procedures in the manufacturer's manual, and verify that all switches and controls operate properly.

4. Leak check the analyzer using appropriate methods for the type of sampling system used.

5. Measure the output of each power supply and record the voltages in the comment section of the acceptance test mini report.

Y.2.0.3 OPERATIONAL TESTS

Perform the following operational tests using a strip chart recorder connected to the analog output and record the results on the mini report. Cut the recorder charts in 24-hour segments, and label the bottom of the chart with the following:

Test performed (across the bottom of chart).

Date.

Make, model number, and serial number of test analyzer.

Range on which test is performed.

Recorder trace color identification if appropriate.

Recorder identification.

Clear, precise notations should be entered on the chart indicating when the tests were started and ended, pertinent information regarding sample flow, gas concentrations, voltages, interfering gases, etc., and any unusual conditions observed. Tests should be run in the range normally used in field operations. All tests should be run in parallel with a control analyzer and recorder whose charts are labeled as above.

1. Initial Start-Up - See Section Y.1.1.2.

2. Analyzer Alignment - See Section Y.1.3.4.

3. Zero and Span Stability - Using an Environics 9100 Calibrator and an appropriate gas standard (super blend), adjust the zero and span controls of the analyzer for proper response. Manually or by using the Calibrator timer program, run the zero and 80% span points. If performed manually, record mass flow controller readings on the recorder strip chart. After 24 and 72 hours, repeat the zero and span using the same calibrator settings. Using the stability test stamp, record the readings on the chart at the end of each test period. Record the changes in zero and span on the mini report. Compare the responses of the test analyzer to the purchase specifications.

4. Linearity - Using the Calibrator remote program #8, perform a linearity test at 80, 40, 20, 10, 8, 6, 4, 2% of full scale. The predicted response is calculated using the responses of the control analyzer as illustrated by the following table (typical response of the Teco 14 B/E control analyzer are shown in column 2; typical responses of the CO analyzer under test are shown in column 3).

Level	Control Net %FS Chart	Test Net %FS Chart	Predicted (Calculated)	Non-Linearity %FS (Calculated)
80	83.1	82.5	----	----
40	41.6	41.0	41.3	-0.3
20	20.5	20.6	20.4	+0.2
:	:	:	:	:
:	:	:	:	:
2	1.8	1.9	1.8	0.1

i.e., the predicted value at the 40 level = $\frac{41.6}{83.1} \times 82.5 = 41.3$

The non-linearity at this level is 41.0 - 41.3 = -0.3%

Record the test results on the chart using the rubber stamp form, and transfer the non-linearity numbers to the mini report. Compare the responses of the test analyzer to the purchase specifications.

5. Temperature and Voltage Stability - Place the test analyzer in the Thermotron environmental chamber, and connect the analyzer power cord to the variable voltage power strip. Connect the sample inlet to the sample manifold supplied with the calibrator output. The control analyzer should remain external to the chamber running on normal house power. Run a temperature/voltage run using Thermotron program number 7 while the test and control analyzer are sampling zero air. Repeat the temperature/voltage run while the analyzers are sampling a concentration equal to 80% of full scale. Record the tests results on the chart using the rubber stamp form. Compare the responses of the test analyzer to the purchase specifications. Transfer the tests results to the mini report.

6. Noise - The peak to peak noise during any of the tests should be less than 2 x the specification. Record the maximum peak to peak noise during the zero and span stability tests on the mini report.

7. Calibration - Perform a multipoint calibration on the using the calibration procedures outlined in Appendix Y.3.

   NOTE: Analyzer must be calibrated for the range on which it will be operated.

Y.2.0.4 FINAL REVIEW

If acceptance tests are satisfactory, an equipment relocation notification tag should be completed, and pertinent information such as final sample flow, zero, and span settings, etc. should be recorded in the log book and on the Acceptance Test "Mini Report." The analyzer is ready for field use.

TECO MODEL 48 CARBON MONOXIDE ANALYZER
ACCEPTANCE TEST "MINI" REPORT

Date__________ Serial No.__________ Reviewed By__________
By__________ ARB No.__________ Date of Acceptance__________

I. Physical Inspections

	Pass	Fail	Final OK
A. Checked for shipping damage..	____	____	____
B. Checked all electrical wiring...	____	____	____
C. Checked all plumbing for leaks.....................................	____	____	____
D. Analyzer complete upon receipt...................................	____	____	____

II. Operational Tests (all tests performed on 0-50ppm range)

A. Acceptable Diagnostic Values. (See Analyzer Manual)

	%FS Dev.	Pass	Fail	Final OK
B. Zero and Span Drift				
1. 24 Hour Zero Drift...	____	____	____	____
2. 24 Hour Span Drift@_____ppm......................	____	____	____	____
3. 72 Hour Zero Drift...	____	____	____	____
4. 72 Hour Span Drift@_____ppm......................	____	____	____	____
C. Line Voltage Test (105-125 VAC@_____ppm)..	____	____	____	____
321 D. Temperature Test				
1. Zero Shift: Step1_____°C to _____°C.........	____	____	____	____
Step2_____°C to _____°C.........	____	____	____	____
Step3_____°C to _____°C.........	____	____	____	____
2. Span@____ppm Step1_____°C to _____°C........	____	____	____	____
Step2_____°C to _____°C.........	____	____	____	____
Step3_____°C to _____°C.........	____	____	____	____
E. Sample Flow Variation Test@________slpm......	____	____	____	____
F. CO Scrubber Efficiency Test..............................	____	____	____	____
G. Linearity				
1. 80% Full Scale@_________ppm.....................	____	____	____	____
2. 40% Full Scale@_________ppm.....................	____	____	____	____
3. 20% Full Scale@_________ppm.....................	____	____	____	____
4. 10% Full Scale@_________ppm.....................	____	____	____	____

H. Final Analyzer Readings
Sample Flow:_________sccm@________Flow Setting; Span Pot:_______ Range:____

III. Special Tests

IV. Comments/Maintenance Performed

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Figure Y.2.0.1
Acceptance Test “Mini” Report

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APPENDIX Y.3

CALIBRATION PROCEDURES

FOR

TECO MODEL 48 CARBON MONOXIDE ANALYZER

MONITORING AND LABORATORY DIVISION

APRIL 1996

Y.3.0 CALIBRATION PROCEDURES

Y.3.0.1 INTRODUCTION

The ARB calibrates carbon monoxide (CO) analyzers using a precise quantitative dilution, with air, of a compressed cylinder of known CO gas. A compressed gas cylinder of CO is diluted with zero air. Zero air is mixed with the CO using a calibrated dilution apparatus to provide five concentrations from 0 to 90% of the analyzer's operating range. The CO standard is initially certified against a NIST-SRM and thereafter recertified annually. The dilution apparatus (mass flow controller, etc.) is also certified and recertified every three months against laboratory flow standards.

Y.3.0.2 APPARATUS

Figure Y.3.0.1, is a diagram of a typical CO dynamic calibration system. Connections between components in the calibration system downstream from the CO cylinder should be of glass FEP Teflon*, or other nonreactive material.

1. Dilution apparatus, including two calibrated mass flow controllers (MFCs), two digital panel meters (DPM), and manual or solenoid valves for positive gas shut-off, such as a Dasibi 1009 MC Calibrator or equivalent.

2. CO Standard - Certified and traceable to a NIST CO Reference Material.

3. Zero Air - Air containing <0.1 ppm CO provided by the Aadco zero air system, CSI calibration unit, zero air cylinder, or other zero air sources.

4. One-quarter or one-eighth inch FEP Teflon tubing for airflow connections. All fittings in contact with CO must be made of 3/16 stainless steel or FEP Teflon.

5. Calibration Datasheet (Figure Y.3.0.2).

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* Trademark of Dupont Corporation.

Y.3.0.3 AS-IS CALIBRATION

Other than routine daily checks, analyzer repairs or adjustments should not be made prior to the (as-is) calibration.

1. Record analyzer parameters and site conditions on the Calibration Datasheet (Figure Y.3.0.2). Refer to the Manufacturer's Instruction Manual, Chapter IV, for detailed information regarding the calibration of the TECO 48.

2. Precautions must be taken to remove contaminants from the CO pressure regulator:

   a. Purge the regulator and delivery system with CO to a safe vent after opening the cylinder valve.

   b. If possible, leave the regulator on the cylinder between calibrations (only if there is no transport involved).

3. Find the CO operating range.

4. Using FEP Teflon tubing, connect the CO and zero air to the appropriate inlet fittings on the dilution system.

5. Disconnect the analyzer's sample probe at the station's sampling manifold, and connect it to the outlet manifold of the dilution system apparatus. Cap the open port on the station's sampling manifold.

6. If using a zero air cylinder, attach and flush the zero air regulator, being careful not to introduce contamination.

7. Once the dilution air flow rate is chosen, determine the required flow of CO gas to obtain approximately 90% of full scale. (Use the following equation and those provided with the mass flow meter transfer standards. Record the mass flow meter equations on the Calibration Datasheet). Do not adjust either MFC to less than 10% of full scale.

$$F_{CO} = \frac{(C_O)(F_a)}{C_{CO} - C_O}$$

where: F = CO flow, sccm

F_a = Air flow, sccm

C_{CO} = CO cylinder concentration, ppm

C_O = desired concentration (diluted CO concentration, ppm)

8. Open the air regulator outlet valve on the dilution apparatus; set the flow so that when the CO gas flow rate is at its maximum, the diluted CO concentration is calculated to be approximately 90% of full scale. The total flow must exceed the total demand of the analyzer(s) connected to the calibrator's output manifold to insure that no ambient air is pulled into the manifold vent (see caution note below). Allow the analyzer to sample zero air until a stable zero response is obtained. Adjust the analyzer's zero control to obtain the required zero set point on the chart recorder and again allow the analyzer to stabilize. Obtain approximately 10 minutes of stable recorder trace and record the response on the Calibration Datasheet.

9. Adjust the CO gas flow (F_{CO}) to the value calculated in Step 8 with the MFC potentiometer set to obtain approximately 90% of full scale. It may require an hour or more for the reading to stabilize as the MFC, dilution apparatus, and analyzer must be conditioned to the calibration gas.

   CAUTION: Vent or scrub the excess CO from the outlet manifold to the outside using a large diameter vent line.

10. After the recorder chart response has stabilized, record the MFC displays, and calculate actual sccm for the CO gas and dilution air flow, and the recorder chart response on the Calibration Datasheet.

11. Reset the CO MFC potentiometer to obtain responses of approximately 50%, 20%, and 10% of full scale. After the analyzer has stabilized for each point,

record the MFC displays and calculate actual sccm and the corresponding recorder chart response on the Calibration Datasheet.

12. Repeat the zero reference point (Step 8). Allow the zero trace to stabilize on the recorder chart. The zero response should reproduce the original zero within 1% of full scale. If it does not, determine the cause and correct the problem before continuing (refer to Section Y.1.4.2, Electronic Malfunctions).

13. Calculations:

NOTE: The calculations assume that the CO analyzer is linear, i.e., the calibration curve of the net chart recorder response versus concentration is a straight line within 1% of full scale at each point. If it is not, troubleshoot the analyzer and calibration system, and correct the problem before continuing.

a. Calculate the CO and dilution air flow rates, sccm, using the certification equations provided.

b. Using the flow rates calculated for Steps 7 and 11, in sccm, calculate the true CO concentration for each calibration point. Record under "[CO] " on the Calibration Datasheet.

$$\text{True CO, ppm} = \frac{(C_{CO})\,(F_{CO})}{F_{CO} + F_a}$$

c. Determine the net DAS response in ppm, subtracting the average DAS zero response.

d. Calculate the deviation from true CO concentrations:

$$\text{\% Dev.} = \frac{\text{CO Net DAS}}{[CO]_{OUT}} - 1 \times 100\%$$

Where Net DAS = Net Data Acquisition System

NOTE: Data for the above equations are recorded on Calibration Datasheet.

NOTE: Data for the above equations are recorded on Calibration Datasheet.

e. Calculate the least square linear regression coefficients (slope and intercept) using all calibration points, including zero points and record on the Calibration Datasheet.

$$y = mx + b$$

Where x = true CO concentration, ppm = [CO]out
y = Net DAS, ppm
m = slope (unitless)
b = y-intercept, ppm

f. Calculate the (As-Is) change from the previous calibration:

$$\frac{\text{As-Is Slope - Old Slope}}{\text{Old Slope}} \times 100\%$$

g. Plot the CO calibration curve, Net DAS or net chart versus [CO]out.

h. If the slope, m, is between 0.95 and 1.05, and b agrees with the zero reading within 1% of full scale, then the analyzer is in calibration, and no further adjustments are needed.

Y.3.0.4 FINAL CALIBRATION

If the slope, m, calculated in Step 13e is less than 0.95 or greater than 1.05, an adjustment and (final) calibration are necessary. Adjust the CO analyzer to correct the deviation as follows:

1. Repeat the 90% of full scale span concentration (Section Y.3.0.3, Step 9).

2. Adjust the front panel span thumbwheel switch until the analyzer reads the true CO concentration.

NOTE: Increasing the thumbwheel switch number increases the analyzer's response.

3. Repeat the zero reference point (Section Y.3.0.3, Step 8).

4. Repeat Steps 1 to 3 in this section until no further adjustments are needed.

5. Repeat calibration points (90%, 50%, 20% and 10% of full scale) for the (final) calibration. Complete the Calibration Datasheet and a calibration curve.

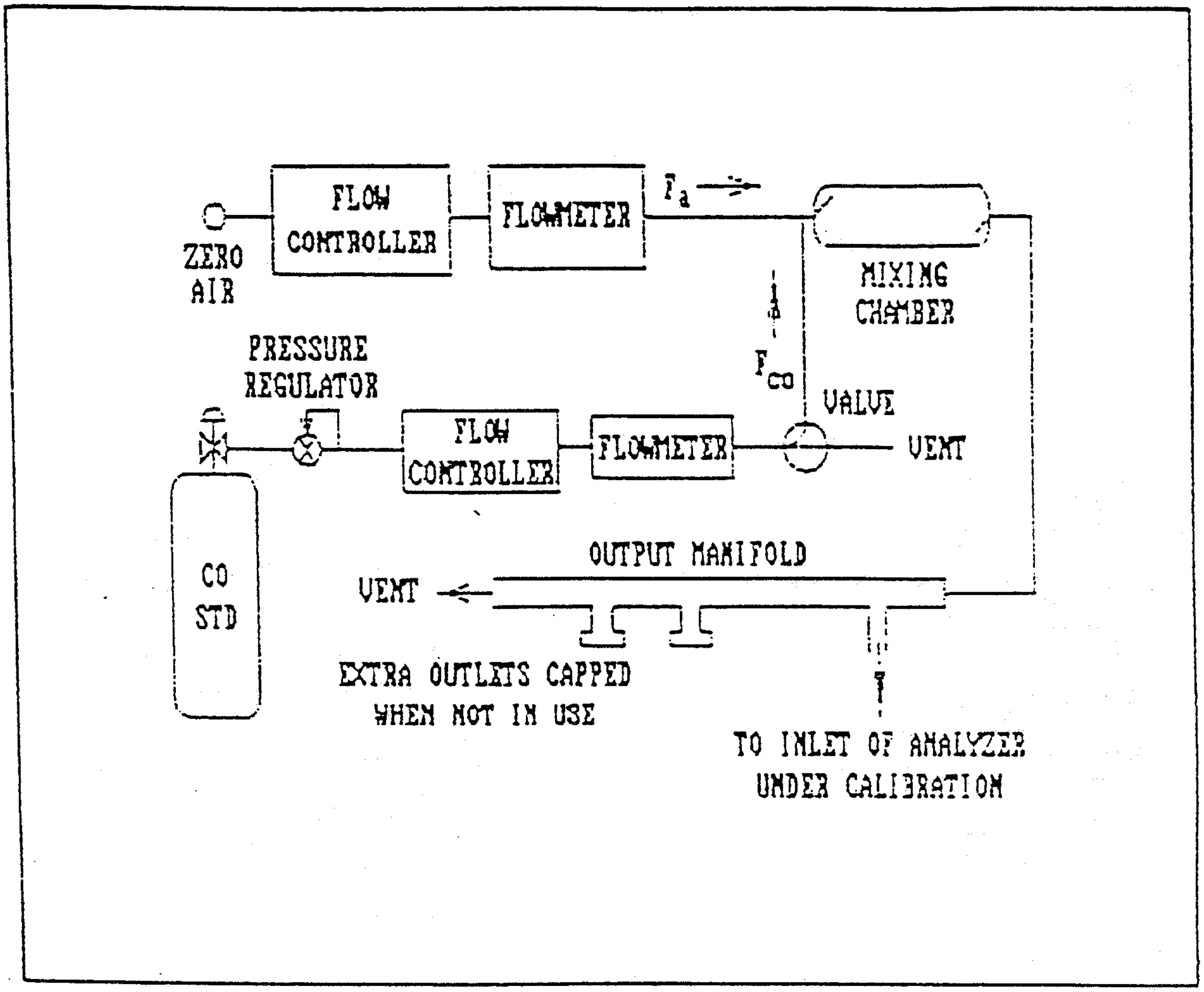

Figure Y.3.0.1
Typical CO Dynamic Calibration System Diagram

CALIFORNIA AIR RESOURCES BOARD
DYNAMIC CO CALIBRATION DATASHEET

Site Name ________________________________ Calibration: As Is ______________ Final ________________
Site No. ________________________________ Date ____________ Log No. _________________________
Site Temperature ___________________________ Barometric Pressure ___________ Site Elevation ________
INSTRUMENT: Make and Model __________________________________ Property No. ___________________
Serial No. ____________________________ Span __________________ Zero ________________________
Range _______________ Airflow _____________________ slpm. at ___________________ setpoint
Primary Data Aquisition System (DAS): Make and Model ____
Property No. ______________________________ Serial No. _______________________________________
Transfer Standard: Make and Model ____________________________ Property No. ____________________
Serial No. __________________________ Date Certified _______________ Cert Expires _______________
0-100 sccm MFC: Airflow = ________________________ Display ± __________________sscm (C0 gas)
0-10 sccm MFC: Airflow = ________________________ Display ± __________________sscm (C0 gas)
Compressed Gas Cylinder: Cylinder No. ______________________ Cylinder Pres. _______________________ psi
Assay __________________ ppm Date Certified ________________ Cert Expires ______________________
Outlet Pressure ____________________________ psi
Dilution Air: Source ____ Property No. ___________________
Outlet Pressure ____________________________ psi

Transfer Standard					[CO]out (ppm)	Instrument		
CO Gas Flow		Dilution Unit		Total Flow		Chart (% FS)	DAS (ppm)	Net DAS
Display	sccm	Display	sscm	sscm				
					3 =			3=

Percent deviation from True: - $\frac{3\text{CO Net DAS}}{3(\text{CO})\text{est}}$ -1 ì x 100% = ___________ %

Linear regression: Analyzer response, ppm = (_______) x [CO]out ± (________)
Slope Intercept

As is change from previous calibration, dated _________________ :

- $\frac{\text{As Is Slope - Old Slope}}{\text{Old Slope}}$ ì x 100% = (___________) x 100% = (________) %

Comment: ____

Calibrated by: _______________________ Checked by: ________________________

MLD-113 (12/91)

Figure Y.3.0.2
CO Calibration Datasheet